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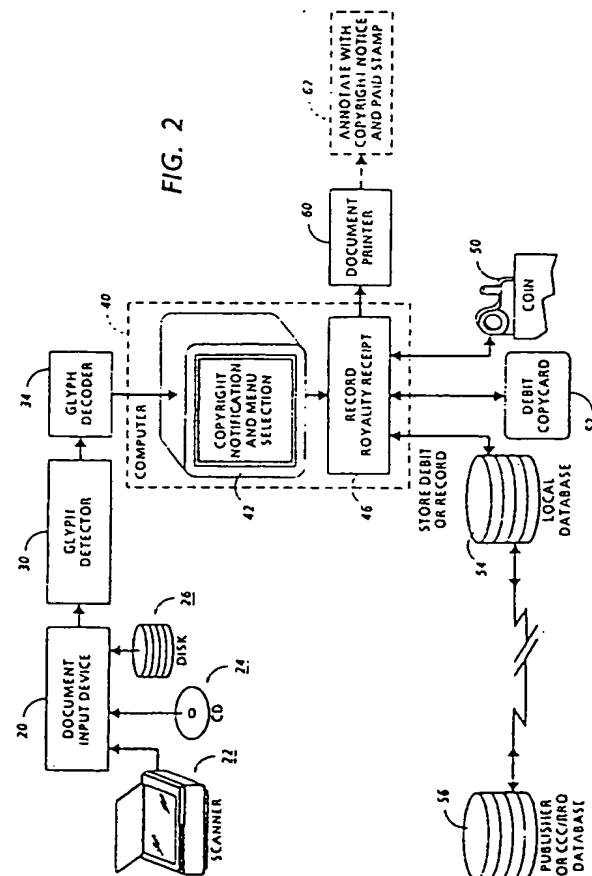
(71) Applicant : XEROX CORPORATION
Xerox Square
Rochester New York 14644 (US)

(72) Inventor : Daniele, Joseph J.
321 Thornell Road
Pittsford, NY 14534 (US)

(74) Representative : Johnson, Reginald George et al
Rank Xerox Ltd
Patent Department
Parkway
Marlow Buckinghamshire SL7 1YL (GB)

(54) A system and method to measure and accrue copyright royalties.

(57) The present invention is a system for utilizing a printable, yet unobtrusive glyph or similar two-dimensionally encoded mark to identify copyrighted documents. Upon attempting to reproduce such a document, the glyph is detected by a detector (30), decoded by a decoder (34) and used to accurately collect and/or record a copyright royalty for the reproduction of the document, or to prevent such reproduction. Furthermore, the glyph may also include additional information so as to enable an electronic copyright royalty accounting system, capable of interpreting the encoded information, to track and/or account for copyright royalties which accrue during reproduction of all or portions of the original document.



This invention relates generally to a method and apparatus for detecting the copying of a document protected by a copyright on a reprographic device, and more particularly to the automatic collection and/or recording of copyright royalty fee information based upon encoded copyright information recorded on the copyrighted document.

Reprographic devices (by which is meant devices intended for the convenient reproduction in hardcopy form of documents, whether said documents are in paper, other hardcopy, or electronic form prior to said reproduction, including photocopiers, electronic printers, digital copiers, telecopiers, spirit duplicators, and the like) are used to reproduce all types of documents, including documents that should not be reproduced, or whose reproduction should be limited, tracked or controlled. One common example of a potential abuse of reprographic devices is the copying or reprinting of materials subject to copyright. Recently, many governments have updated copyright laws, and worldwide efforts have been underway to develop a means by which authors and publishers can be fairly recompensed for such copying. Non-profit national collectives, for example the Copyright Clearance Center in the United States, usually referred to as Reproduction Rights Organizations (RRO's), implement copyright licensing systems and convey royalties to the authors and publishers. The RRO's derive their authority from national legislation, contracts with the authors and publishers, and bilateral agreements with other RRO's.

Generally, an RRO pursues the licensing of specific organizations, for example, schools, governments, and private enterprise. In some cases the RRO may grant permission, on a case-by-case basis, for copying particular jobs in return for a specific fee. As an alternative to this transaction-based system, the RRO may grant a blanket license. In a typical blanket license, an organization agrees to pay royalties to the RRO for the reproduction of copyrighted materials over a specified number of years, where the royalty is based upon a sampled survey of the licensee's copier usage.

The licensee pays the RRO a fixed per copy fee for estimated copyright copies for the duration of the license. Paying such fees is often preferable to the licensee than buying the publications or continuing to make illegal copies. Of course, while such schemes are commonly applied to photocopying, they could apply to materials reproduced by other reprographic means, such as electronic printing, digital copying, facsimile transmission (telecopying), etc.

In addition to the determination of copyright percentage, many RRO's track information regarding the bibliographic source and/or content of reproduced copyrighted material, e.g., title, author, publisher, type of work (prose, poetry or music, percentage which is photography etc.), from the sampled data, so

that individual authors and publishers, or their organizations, can receive proper royalty payments for their works. The published works that are being copied are constantly changing, thus samplings must be repeated on an ongoing basis to ensure that appropriate authors and publishers are identified. Fig. 1 illustrates one such typical copyright compliance system. Further description of the various systems and licensing plans employed by the Copyright Clearance Center are found in an advertising brochure entitled Creating Copyright Solutions, distributed by the Copyright Clearance Center, Salem, MA.

Heretofore, manual sampling techniques have been used to collect sample data on copyright copying. Unfortunately, the sampling procedure is cumbersome. The techniques typically require the copier user to complete a detailed form, or to make an extra copy of the whole copy job together with a notation of the number of copies made. A recent system available from ALLDATA Abrechnungs- und Sicherheitssysteme GmbH of Villengen, Germany, automatically keeps track of the number of copies made in a copy job, but still requires the copier user to enter, via keyboard, an ISBN/ISSN number (the standard international book and serial numbering systems), or to input it using a manual bar-code "wand" if such a code is available on the document. The need for such cumbersome techniques has had a significant impact on the time needed to enter the information, the accuracy of the sampling performed, and the completeness of the information regarding the authors and publishers. Accordingly, the RRO's, authors and publishers commonly receive less than optimal reporting, and income, for the reproduction of copyrighted works. Further, the difficulty of the sampling techniques discourages user organizations from executing licenses with the RRO's, thus greatly reducing the RRO's potential income. If the samplings capture incomplete author and publisher information, the authors and publishers do not receive fair individual recompense; bar-codes, for example, (even if available) typically only refer to the whole publication, like the underlying ISBN/ISSN, and do not identify the authors of individual articles. Finally, with systems of the ALLDATA type, it is difficult to categorize the nature of the content of the reprographic job (such as prose versus poetry versus music, or the proportion of photographic material), as required by some RRO's, again since most bar-code schemes only identify an entire publication or are limited to numerical classifications.

US-A-4,173,408 to Stewart, assigned to Xerox Corporation, discloses a transaction accounting system for the automated royalty accounting of copyright-coded microfiche documents.

US-A-4,179,212 to Lahr, assigned to Xerox Corporation, discloses a transaction accounting system for the automated royalty accounting of optically transparent copyright-coded paper documents. The

complete automated transaction accounting system includes a document copier and a copier access control system including a transaction data terminal for input of transaction information such as the date of the transaction, coded copyright information such as information contained in the ISSN/ISBN number, user identification and number of copies to be produced. Information about the bibliographic source of the document (such as the ISBN/ISSN number) is either coded into the document, or must be input by the user, either by scanning a special bar-code imprinted on the document or by keyboard entry.

The Lahr system cannot be used with any document which does not have the special conductive coating, so it is not applicable to the great majority of published and copyrighted documents. Moreover, the system cannot reproduce the electrically conductive coating on the copy, so that subsequent reproductions would not be detected. The system would be difficult to use with a plurality of different reprographic devices, since it requires a special document platen to sense the paper conductivity; this would make it difficult to economically install such a device on existing reprographic devices. Further, the system is very manual in nature, unless a bar-code is applied to the surface of the document in addition to the electrically conductive coating. Finally, it is very difficult to identify the author of a particular copied portion of a publication, such as a magazine article, or to categorize the nature of the content of the portion (such as prose versus poetry versus music, or the proportion of photographic material), since most bar-code schemes only identify an entire publication.

US-A-4,728,984 and US-A-4,786,940 to Daniele, both assigned to Xerox Corporation, disclose data handling and archiving systems. An electronic printer having an image input scanner is used for scanning the documents. The printer is equipped with a recognition circuit that reads a bar or other code on the document to distinguish encoded documents from other non-coded documents. The system does not track the copying of certain documents but rather reads the special coded digital images previously placed on the input document, decodes said images and either prints a message based on their content or uses their content as auxiliary software to control the operation of the printer.

US-A-4,908,873 describes a system for selectively effecting the operation of a copying or facsimile machine in accordance with the textual content of a scanned document.

US-A-4,977,594 discloses a digital database usage metering, billing and security system.

The Xerox Disclosure Journal, Vol. 4, No. 1 (Jan./Feb. 1979) publication by Hickey describes a copyright accounting system wherein the information necessary for establishing a copyright royalty is contained on an index-type card or bar-code associated

with each book or periodical maintained in a library.

Unfortunately, the aforescribed systems often require operator intervention so as to accurately sample the copying. On the other hand, where the pertinent information is incorporated in a discernible mark on the document, recognition of the information may be avoided by covering-up the recognizable identification/information thereon. One object of the present invention, on the other hand, is directed toward a method and apparatus for overcoming these existing drawbacks of document tracking and copyright sampling or accounting systems.

Accordingly, the present invention relates to a system, apparatus and method according to the appended claims.

In accordance with one aspect of the present invention, there is provided a system to account for copyright royalties accrued as a result of printing a copyrighted document on a document printer, including: a digitized representation of the copyrighted document having a printable code on each page thereof, said representation being provided for reproduction by the document printer; means for detecting the presence of the printable code in said digitized representation of the copyrighted document; means for decoding the printable code; means, responsive to said decoding means, for determining a copyright royalty due for reproduction of the copyrighted document; and accounting means for recording the copyright royalty due.

In accordance with another embodiment of the present invention, there is provided an apparatus, associated with a reprographic device, for tracking the reproduction of at least a portion of a copyrighted document having a visible glyph code on each page thereof, said apparatus comprising: means for scanning the visible glyph code contained on at least a portion of a document page being reproduced by said reprographic device and generating a plurality of digital signals representative thereof; memory for storing the digital signals generated by said digital scanning means; and means for decoding the visible glyph code represented by the stored digital signals so as to determine if a copyright royalty is associated with the reproduced page.

In accordance with yet another embodiment of the present invention, there is provided an apparatus to prevent the unauthorized reproduction of copyrighted materials on a document printer, including: an original document, input for reproduction by the document printer, said original document having a printable glyph code on each page thereof; means for sensing the presence of the printable glyph code on at least one page of said original document; means for decoding the printable code; means, responsive to said decoding means, for determining that the document is copyrighted; and means for disabling the reproduction of the document upon a determination that

the document is copyrighted.

In accordance with yet another embodiment of the present invention, there is provided a method of assuring payment of copyright royalties accrued as a result of printing a copyrighted document on a document printer, including: scanning at least a portion of the copyrighted document to produce a digitized representation thereof, said copyrighted document having a printable code on each page thereof; detecting the presence of the printable code in the digitized representation of the scanned portion of the copyrighted document; decoding the printable code; and determining, from said decoding step, if a copyright royalty is required for reproduction of the copyrighted document.

The present invention will be described further, by way of examples, with reference to the accompanying drawings, in which:-

Figure 1 illustrates a commonly used system for tracking copyrighted information;

Figure 2 is a schematic diagram of the architecture for a copyright royalty accounting system in accordance with one embodiment of the present invention;

Fig. 3 is a flow chart illustrating a process for reading a glyph code present in a digitized representation of a document;

Figure 4 is an illustration of a document sheet containing the two-dimensional glyph code employed in the present invention;

Figures 5 and 6 are enlarged representations of the glyph markings appearing on portions of the document sheet in Figure 4;

Figure 7 is an elevational view of a digital printer embodiment incorporating the present invention; and

Figure 8 is an elevational view of a light lens xerographic copier embodiment incorporating the present invention.

For a general understanding of the present invention, reference is made to the drawings. In the drawings, like reference numerals have been used throughout to designate identical elements. Figure 2 shows a possible architecture of the electronic copyright royalty accounting system. The apparatus depicted includes a number of primary components which will be described in detail. First, the apparatus includes a document input device 20 which may include one or more of the following well-known devices: a digital image scanner 22 (e.g., a flat bed scanner or a facsimile device), a disk reader 24 having a digital representation of a document on removable media (CD, floppy disk, rigid disk, tape, etc.) therein, or a hard disk 26 having one or more document images recorded thereon. Generally, the apparatus is intended to work with any device suitable for printing or storing a digitized representation of a document. Moreover, because the present invention may also be adapted

for use with a light-lens reprographic machine, input device 20 may also be a scanning array or bar positioned so as to scan an output sheet or similarly developed image being output from the machine (see Figure 6). Alternatively, the scanning array bar may be positioned with a document handler on a reprographic machine so as to scan a portion of an input document being advanced to the imaging platen thereof (not shown).

Once the document has been represented in a digitized form, glyph detector 30 is employed to determine if the digitized document contains any encoded copyright data. As described in the copending and commonly assigned United States Patents of: Dan S. Bloomberg et al., US-A-5,168,147 on "Self-Clocking Glyph Codes"; Xiao Bei Zhang, US-A-5,245,165 on "Self-Clocking Glyph Codes for Encoding Dual Bit Digital Values Robustly"; and publication of David L. Hecht et al., on "Self-Clocking Glyph Code Having Composite Glyphs for Distributively Encoding Multi-Bit Digital Values" EPO-549,315, data may be represented on a document in an unobtrusive manner using multi-bit binary data symbols encoded in a two-dimensional code therein. More specifically, a self-clocking glyph code faithfully preserves the logical ordering of the bits that are encoded in its glyphs because the glyphs are written onto and read from a suitable recording medium in a known order and in compliance with a predetermined spatial formatting rule. Furthermore, such a code also provides the sample clock that is needed for decoding it because every bit that is encoded by the code is explicitly represented by a glyph, either alone in the case of a single bit per glyph code or in combination with one or more additional bits in the case of a multiple bit per glyph code.

In the embodiment depicted in Figure 4, a two-dimensional code would be located in a predefined position on a document sheet, for example, along the bottom of a page as shown by region 150 or along the side margin as shown by region 152. As further illustrated by the enlarged document sections of Figures 5 and 6, the encoded portions of regions 150 and 152, respectively, are distinguishable from the adjacent readable information on the document. In such a case glyph detector 30 may be a commonly known image processing device capable of "windowing" the predefined portion of the digitized document. Alternatively, the two-dimensional code may be placed at other less conspicuous locations and could be detected by an image processing device employing a two dimensional spatial filter, such as a notch or multiple notch filter tuned to very specific frequencies. These two-dimensional codes will faithfully reproduce and be detectable in multiple generations of copies. For example, the two-dimensional code information could be placed as a background behind the text of the document or within the margins of the original document.

In all cases, the glyph code within regions 150 or 152 would be detectable by glyph detector 30 during reproduction of the document.

An important characteristic of the two-dimensional or self-clocking glyph code, illustrated in enlarged form in Figures 5 and 6, is that it is not readily discernible to the person attempting to make an unauthorized copy and, therefore, is less likely to be defeated by covering up the two-dimensional coded information. However, using image processing techniques, the automatic recognition of the glyph code in a digital representation of the image is possible. The glyph codes can be placed in many positions on the page simultaneously, for example, in graphic lines along the side margins, at the top or bottom of the page, or in any gray/halftone areas. Furthermore, glyph codes that run along the margins of a page can be used to identify the copying of specific lines, as may be important in the reproduction of valuable poetry, plays or music. Glyph codes placed as borders around photos, illustrations, or graphics can also enable separate identification of the owners of photographs, as these are often different from the owner of the book copyright.

In yet another alternative embodiment, the glyph codes may be used to prevent copying of portions of a document as well. As indicated above, individual portions of a document may be delimited by the surrounding or adjacent glyph code. Such a code may bear the information that, upon being interpreted by a reprographic system, would crop the delimited portion and prevent its reproduction on the output document.

Referring also to the flowchart of Figure 3, having obtained and stored the pixel map image of the glyph code into memory at 91, such as by input scanner 22 in Figure 2, the decode values for the individual glyphs are then determined at 92 by glyph decoder 34. The locations of the data bytes and parity symbols in the glyph code are known from glyph detector 30, so that information is used at 93 for separating the decode values for those different symbol sets from each other, thereby enabling the decode values for the respective symbol sets to be stored at independently addressable memory locations.

For correcting correctable decode errors, the memory array initialization, data transfer and scan steps at 101, 102 and 103, respectively, are described by David L. Hecht, in Japanese application published under JP-6,075,795 on "Logically Independent Sub-array Tilings of Glyph Codes for Reduced Hard Error Susceptibility". Each scan 103 produces a string of symbols that are correlated with a respective one of the anticipated burst error patterns, so the parity symbols for that particular error pattern are appended or otherwise associated with the symbol string at 105 in preparation for correcting errors that might exist. If, the error correction process 106 returns correct data,

as determined at 107, the data bytes are read at 108 to reconstruct the encoded copyright message information. On the other hand, if it is found at 107 that the decode errors are not susceptible to correction, the process may be repeated, as at 111, using the next scan pattern. If decode errors still exist after all of the scan patterns have been tried, as determined at 112, an error flag is suitably set at 114 prior to terminating the process. The error flag may be interrogated so as to enable copying without recording copyright information, or to inhibit copying based upon an assumption that the document is copyrighted.

Once the glyph code is successfully decoded into a digital data format representing a plurality of alphanumeric characters, for example any well-known information interchange code, the data represented therein may be parsed to determine copyright and related information for the original document. More specifically, the digital information could be a representation of ASCII data which would then be parsed to determine one or more of the following: a) an indication of a copyright for the document; b) an identification number for the document (i.e., ISBN, ISSN, etc.); c) an indication of the publisher and/or author of the document and an electronic address or equivalent indication of information necessary to properly transfer funds or notify the copyright holder; and d) the copyright royalty due as a result of copying the all or portions of the document, including any discounts applicable for multiple reproductions.

Having decoded the glyph and parsed the information represented therein, a general purpose microprocessor-based computer 40 may be used to perform one of a number of transaction or recording events. In the simplest form, computer 40 would, via information display 42, provide a visual indication to an operator that the document was subject to copyright protection. The computer, being interfaced to the printing system, could then prevent subsequent printing of the document until an indication of copyright royalty receipt was present, for example, as indicated by royalty receipt recording device 46 in Figure 2. Such an indication might be provided by a signal from either of the commonly known coin slot 50 or copy card 52 type systems presently found on many convenience copiers in libraries and other public areas.

Alternatively, more advanced reprographic and printing systems could employ an accounting or database type system 54 to track the accrual of copyright royalties, or merely the number of copies made of copyrighted documents. As yet another option, local database 54 could periodically transmit or upload the copyright royalty information to the databases of individual publishers or an RRO as represented by database 56.

Once the copyright royalty information and or payment is accounted for by copyright royalty recording means 46, computer 40 enables the operation of

document printer 60 to reproduce the document as specified by the operator. In one embodiment, the printer may be able to reprint the glyph code in the location in which it was sensed by glyph detector 30. In a simple form, reprinting the glyph would be accomplished during the normal reproduction of the document. However, in a printer which reproduces the document from a digital image representing the original document, the glyph could be reprinted on the document without any of the degradation commonly found in documents reproduced from prior reproductions (e.g., multi-generation copies). More specifically, the portion of the document containing the glyph information, assuming it was separable from the content portion of the document, would not be reproduced from the digitized input obtained from the original document. Rather, the glyph portion could be printed anew in response to a re-coding of the decoded glyph information. In this way, the glyph portion of the image would avoid the degradation associated with digitization and subsequent reproduction. Moreover, new information could also be added in this manner. For example, an indication of what generation the copy is, where and when the original copy was made could be added to the document to enable an audit of the system. Also, if available, an identifying number or code representing the individual and/or document printer could be annotated as a glyph code on the document.

As represented in Figure 2 by the annotation device 62, printer 60 may also contain the capability to accomplish one or more annotation operations on the reproduced document. In one embodiment, the annotation could be in the form of a copyright notice reproduced on the copy. Alternatively, the annotation device could be used to mark the document with an indication that a copyright royalty had been accrued/paid for the reproduction of the document. Such a device might accomplish the annotation using an alternate or highlight color marking ink, or by placing a mark along a border of the reproduced document.

Turning now to Figure 7, the present invention will be particularly described with respect to an electronic printing embodiment. As illustrated, the electronic printing system is comprised of a printer 200, a network 202 and an image source 204. In normal operation, printer 200 is in communication with image source 204 which may be any scanning, digitizing or page composition workstation capable of providing a digitized representation of a document to be printed. While it is conceivable that image source 204 is an image scanner directly associated with printer 200 as, for example, in the Xerox® Docutech® Production Publisher, the printer may also be a work group printer attached to a network as illustrated. Residing, on the network or within the hardware of the printer at a location suitable for monitoring bit-map image data sent to printer 200, is RRO Interface 210. Similar to the

computer of Figure 2, the purpose of the RRO Interface is to monitor the image data sent to be printed in order to detect the presence of digitized glyph codes within the bit-map image which indicate that the document being sent for printing is subject to a copyright. An important aspect of RRO Interface 210 is that it operates in a manner which is "transparent" to those using the printer to produce hardcopy reproductions and therefore unlikely to be avoided, or overridden by those seeking to avoid payment of copyright royalties.

As previously described, RRO Interface 210 would first detect, decode, and parse the glyph information. If the glyph information is determined to contain copyright information, the RRO Interface would establish a data structure 212 to represent the document printing request. Such a structure would contain the information necessary to correctly identify the document or portion of a publication being reproduced along with the number of copies to be generated. Once the data structure was completed, in accordance with the requirements of the document printing request, the data structure would reflect a copyright royalty transaction, including the amount of copyright royalty due along with an identification of the copyright holder(s) to whom the royalty is due. In one embodiment, the transaction would be stored on disk or non-volatile memory 214 within RRO Interface 210 and later transmitted as one of a batch of transactions via telephone link 218 or similar method to RRO 220. Alternatively, the RRO Interface could compile the transaction data for each document printing request in Random Access Memory and immediately transmit the data to the RRO via link 218.

Once the transaction data is received by RRO 220, it is stored in database 222. Then, periodically, the RRO will generate compiled lists of the copyright transactions transmitted thereto. Using the compiled lists of transactions, the RRO can produce billing or survey results 230 which establish the copyright royalties accrued as a result of documents being printed on printer 200. Moreover, because the copyright transaction data structure included data identifying specific copyright holders, the RRO may also periodically disperse collected copyright royalties to the copyright holders 240 in return for the copyright holder's authorization for the RRO to manage collection of the royalties. Similarly, the same system could communicate directly with those publisher and authors whose interests are not represented by the RRO.

Referring now to Figure 8, an apparatus 310 for tracking reproduction of copyrighted information, or of other information whose reproduction should be controlled, limited or tracked, is illustrated in conjunction with a light-lens reprographic machine 312. Tracking apparatus 310 is detachably connected to a reprographic device 312 in a manner which does not significantly impact the reprographic device. Track-

ing apparatus 310 has a structure enabling it to be attached to a number of reprographic devices with minor adaptations, such as height and mounting means. Tracking apparatus 310 includes a digitizer section 314, memory 318 for storing the output of digitizer 314, and a controller 320. Digitizer 314 and recorder 318 are preferably compactly contained within tower 322. In order to render it more easily attachable to a variety of reprographic devices, tower 322 may be of adjustable height and may have cut-outs and the like to allow positioning in close proximity to various models of reprographic device 312, despite protrusions extending therefrom. Digitizer 314 scans a reproduced document page output from reprographic device 312 to create a digitized bit-mapped image of the copyrighted material. Specifically, the reproduced document page would be a page containing an identifying glyph code bearing the encoded copyright information as illustrated in Figures 4, 5 and 6. Digitizer 314 can utilize an integrated contact image sensor of the type commonly used in facsimile machines. Such an image sensor typically comprises an illumination source, a lens array and an image detector, in one integrated package; said contact image sensor being placed in close proximity to the page being digitized as it exits reprographic machine 312.

Digitizer 314 is preferably attached, as part of tower 322, between the main portion of reprographic device 312 and the paper output portion (by which is meant the output tray, sorter, stapler, etc.) of reprographic device 312. Further details of the adaptation of digitizer 314 with respect to tower 322 and reprographic machine 312 are described by Vincett et al. in application Serial No. 07/790,309 for "Tracking the Reproduction of Documents on a Reprographic Device," the relevant portions thereof being hereby incorporated by reference. As described therein, digitizer 314 also includes rollers and/or guides to guide paper through the digitizer portion of tracking apparatus 310. If the digitizing sensor is in a main paper path, it may be retractable as necessary to permit passage of stapled sets of pages or of thick paper.

Alternatively, since the time required for digitization (which is limited by the speed of the digitizing sensor, such as a contact image sensor) may require each digitized page to be slowed down compared with the speed of reprographic device 312, a deflection of the reproduced document page can be performed by tracking apparatus 310 prior to digitization. After such deflection, each page may be digitized almost immediately, or several pages may be diverted to a separate tray for later digitization; the latter approach prevents the need for any significant delay between output by the main portion of reprographic device 312 of successive pages to be digitized.

Once digitized, an image of each reproduced document page can be stored temporarily in a Random Access Memory or similar storage device 318 in

the same transaction data record previously described. Once the digitized document image is recognized as containing a glyph code bearing copyright information, the reproduced document page is inhibited from exiting tower 322. Upon prompting the operator, via a display on control panel 324, further action is precluded until payment of the requisite copyright royalty fee is indicated as described below. Once paid, the transaction data structure is updated with a "paid" indicator and the information is stored for later retrieval or transmission to the RRO as previously described with respect to the system of Figure 7.

Tracking apparatus 310 is preferably connected to a foreign interface connector (not shown) commonly provided in reprographic device 312. A foreign interface connector enables attachment of third party devices such as coin-operated and auditron (copy counting) accessories. The foreign interface connector communicates with controller 320 by providing a Start Enable/Disable capability for the reprographic device 312 and an electrical pulse for each reproduction made. Controller 320 would use the Start Enable/Disable capability to control (by providing or failing to provide appropriate signals to said connector) the reprographic device so as to inhibit the output of the reproduced document page and prevent further copying of the original document until the appropriate royalty payment is obtained. In the embodiment depicted in Figure 8, an operator may deposit the required copyright royalty via coin slot 326a, dollar bill slot 326b, or by debiting a copy card or credit card inserted into the card reading receptacle 328. Presumably such a system could also be used as a coin-operated reprographic machine for reproducing non-copyrighted documents.

As a stand-alone or personal-use system, the tracking apparatus would require periodic service to empty the accumulated funds paid for the copyright royalties and/or copying charges. Accordingly, the tracking apparatus could also include communication hardware to establish connections with an external system, similar to that previously described with respect to the RRO in Figure 7. As illustrated by the telephone link in Figure 8, communications with an external system would allow the tracking apparatus to transfer the transaction data stored in memory 318 on a periodic basis, thereby enabling the accurate division of funds amongst the proper recipients of the royalties, as illustrated by the personal-use copier block 250 in Figure 7.

If tracking apparatus 310 is used in conjunction with a reprographic device which digitizes the input document (e.g. an electronic reprographic machine), recorder 318 can be arranged to intercept, detect and decode glyphs within the digitized image already present in reprographic device 312, as represented by the system depicted in Figure 7. Accordingly, tracking apparatus 310 does not necessarily digitize

the image from a page output from reprographic device 312. Rather, tracking apparatus 310 may operate on digital images output from reprographic device 312, or may digitize pages output from said device and then operate on the digital images so produced.

In recapitulation, the present invention is a method and apparatus for utilizing a printable, yet unobtrusive glyph or similar two-dimensional encoding scheme to identify copyrighted documents. Upon attempting to reproduce such a document, the glyph is detected, decoded and used to accurately collect and/or record a copyright royalty for the reproduction of the document. Furthermore, the glyph may also include additional information so as to enable an electronic copyright royalty accounting system capable of interpreting the encoded information to track and/or account for copyright royalties which accrue during reproduction of all or part of the original document.

Claims

1. A system to measure and accrue for copyright royalties accrued as a result of printing a copyrighted document on a document printer, including:
 - a digitized representation of the copyrighted document having a printable code on each page thereof, said representation being provided for reproduction by the document printer;
 - an image processing device for detecting the presence of the printable code in said digitized representation of the copyrighted document;
 - a decoder for transforming the printable code into a digital representation of alphanumeric characters;
 - a parser, responsive to said decoder, for determining whether the alphanumeric characters indicate that a copyright royalty is required for reproduction of the copyrighted document; and
 - accounting means for recording the copyright royalty due.
2. A system as claimed in claim 1, further including means for collecting the copyright royalty before printing the copyrighted document.
3. A system as claimed in claim 1 or claim 2, further including:
 - means for electronically recording, along with the copyright royalty due, an account identifier to which said copyright royalty is to be charged; and
 - means for effecting a transaction with the identified account so as to transfer funds at least equal to the copyright royalty due.
4. A system as claimed in any one of claims 1 to 3, further including means for reproducing the printable code on each reproduction of the original document, wherein the printable code on the reproduced document is detectable by the apparatus during a subsequent reproduction operation.
5. A system as claimed in any one of claims 1 to 4, further including marking means for automatically placing indicia on each reproduction of the copyrighted document to indicate that the copyright royalty has been accrued for the reproduced document, thereby designating the reproduction as an authorized reproduction of the copyrighted document.
6. A system as claimed in claim 5, wherein said marking means automatically places encoded indicia on each reproduction of the copyrighted document representing additional information from one or more items of the group consisting of:
 - a time that the reproduction was made;
 - a location where the reproduction was made;
 - an individual who made the reproduction; and
 - a machine identifier indicating the document printer on which the reproduction was made.
7. A system as claimed in any one of claims 1 to 6, wherein said decoder comprises:
 - first parsing means for parsing the decoded data to determine the copyright royalty; and
 - second parsing means for parsing the decoded data to determine additional information from one or more items of the group consisting of:
 - author,
 - publisher,
 - ISBN number,
 - ISSN number, and
 - electronic address of a copyright holder,
 and optionally said first parsing means is capable of determining which pages, lines, photographs and illustrations are being copied from said copyrighted document so as to determine the copyright royalty as a function thereof.
8. An apparatus, associated with a reprographic device, for tracking the reproduction of at least a portion of a copyrighted document having a visible self-clocking glyph code on each page thereof, said apparatus comprising:
 - a scanning mechanism for scanning the visible self-clocking glyph code contained on at least a portion of a document page being reproduced by said reprographic device and generating a plurality of digital signals representative

thereof;

memory for storing the digital signals generated by said digital scanning means; and

a decoder for decoding digital signals representative of the visible self-clocking glyph code within the stored digital signals to determine if a copyright royalty is associated with the reproduced page.

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9. An apparatus as claimed in claim 8, wherein the visible glyph code further delimits a portion of the copyrighted document and/or wherein the visible glyph code delimiting the portion of the copyrighted document further identifies a holder of the copyright for the delimited portion thereof and/or wherein the visible glyph code delimiting the portion of the copyrighted document further identifies that portion of the document as one which is to be cropped during reproduction by the reprographic device.

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10. An apparatus to prevent the unauthorized reproduction of copyrighted materials on a document printer, including:

means for sensing the presence of a printable self-clocking glyph code on at least one page of an original document;

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means for decoding the printable code;

means, responsive to said decoding means, for determining that the document is copyrighted; and

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means for disabling the reproduction of the document upon a determination that the document is copyrighted.

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11. A method of detecting a requirement for payment of copyright royalties accrued as a result of printing a copyrighted document on a document printer, including:

scanning at least a portion of the copyrighted document to produce a digitized representation thereof, said copyrighted document having a printable self-clocking glyph code on each page thereof;

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detecting the presence of the printable self-clocking glyph code in the digitized representation of the scanned portion of the copyrighted document;

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decoding the printable self-clocking glyph code; and

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determining, from said decoding step, if a copyright royalty is required for reproduction of the copyrighted document.

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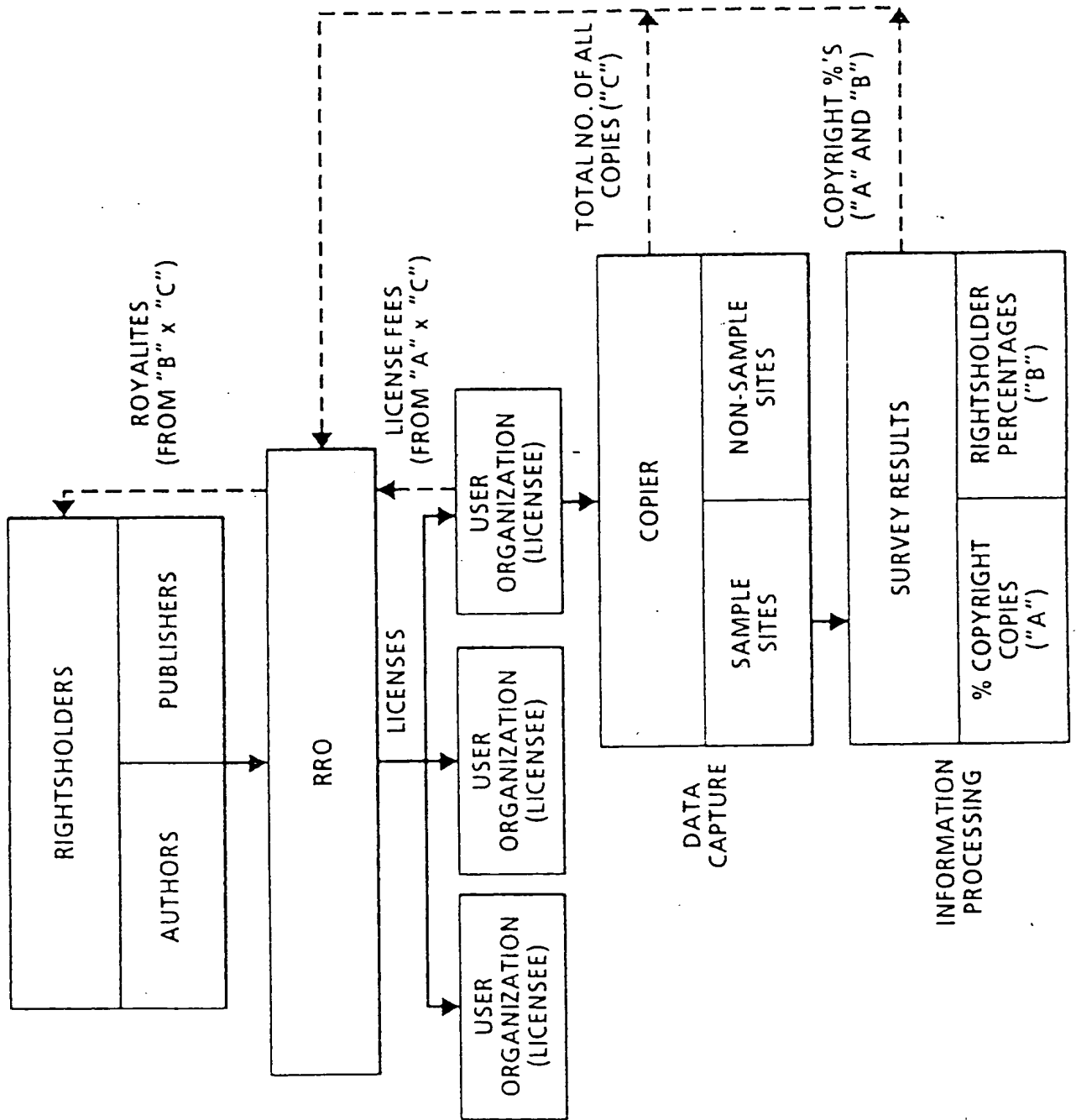


FIG. 1

FIG. 2

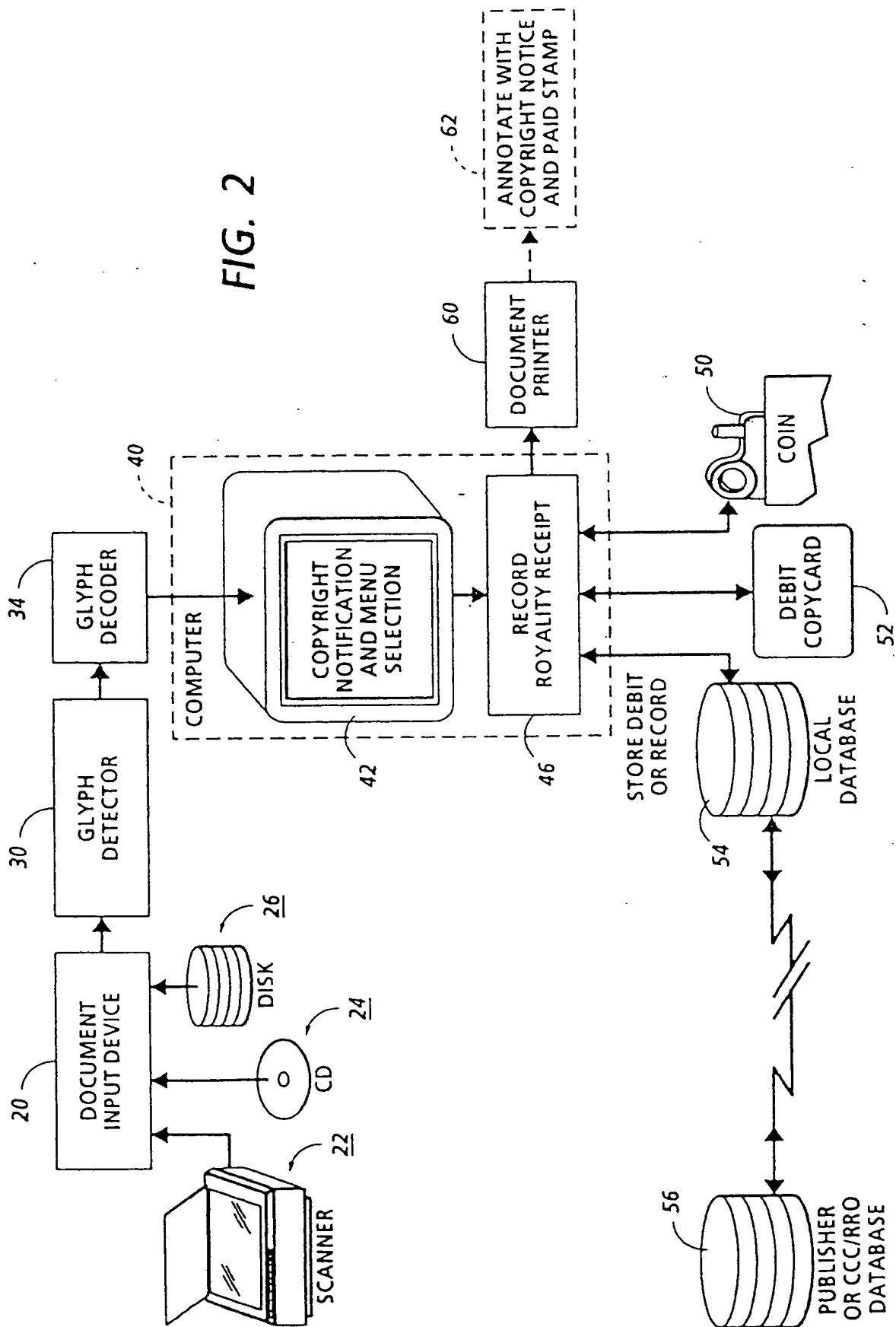


FIG. 3

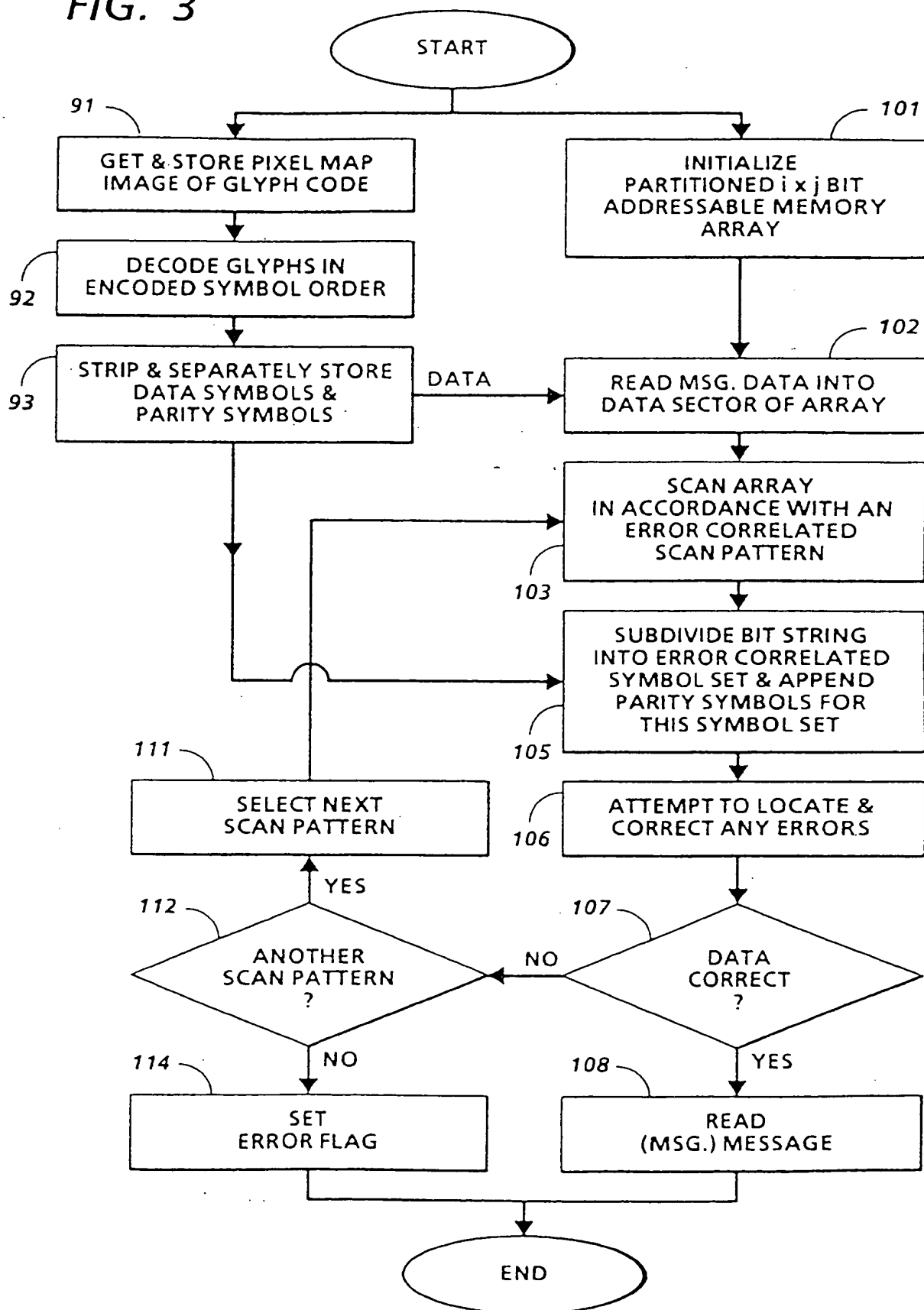


FIG. 4

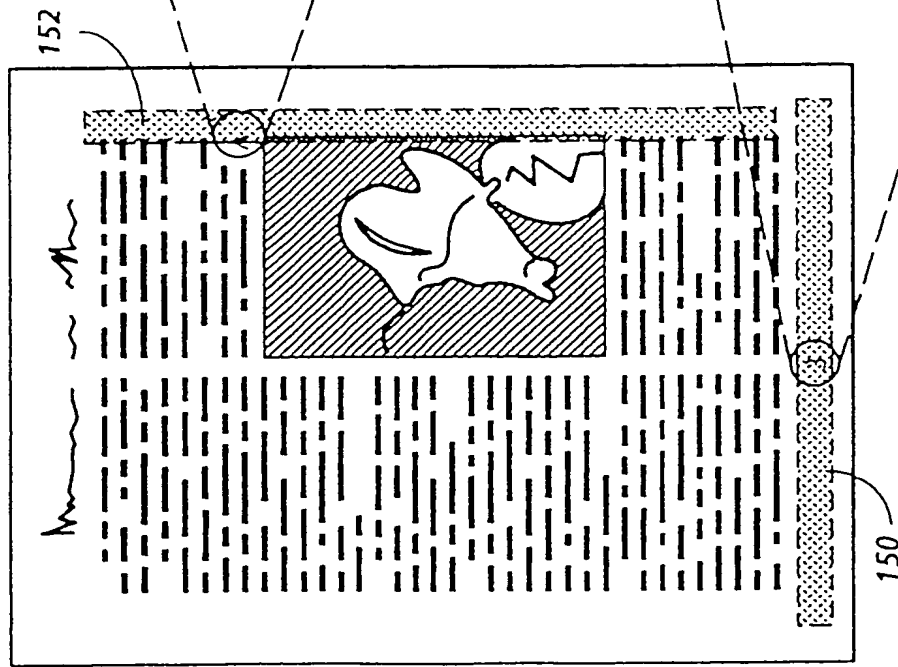


FIG. 6

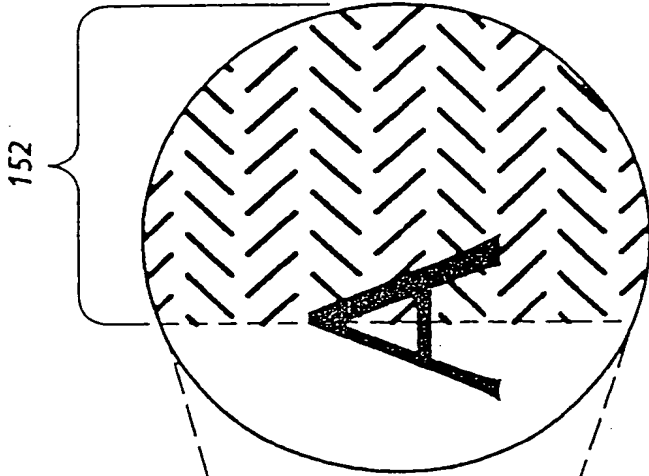
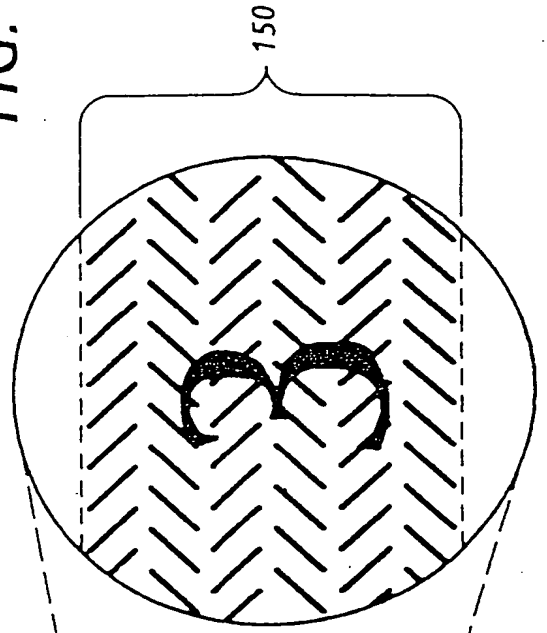


FIG. 5



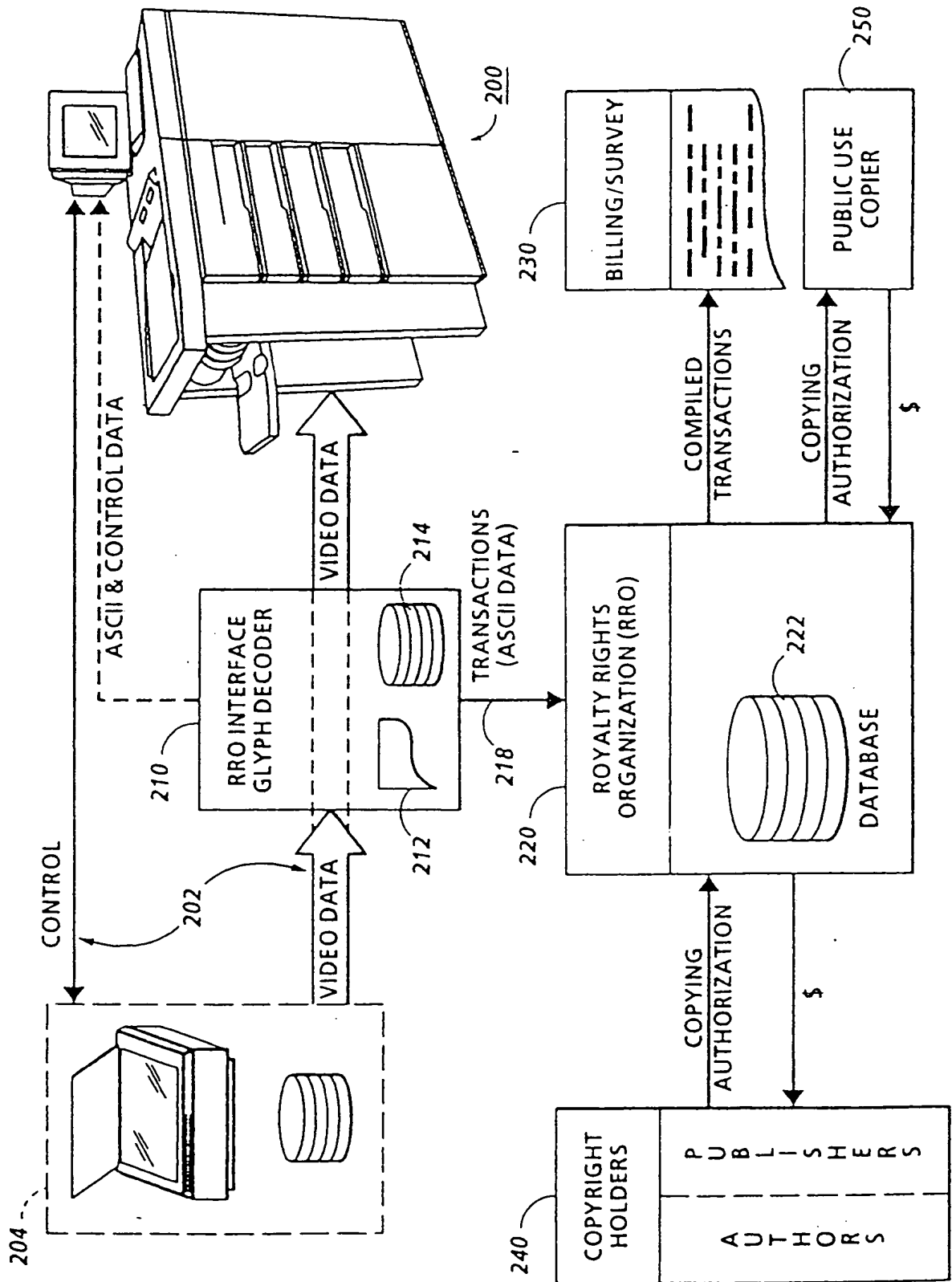
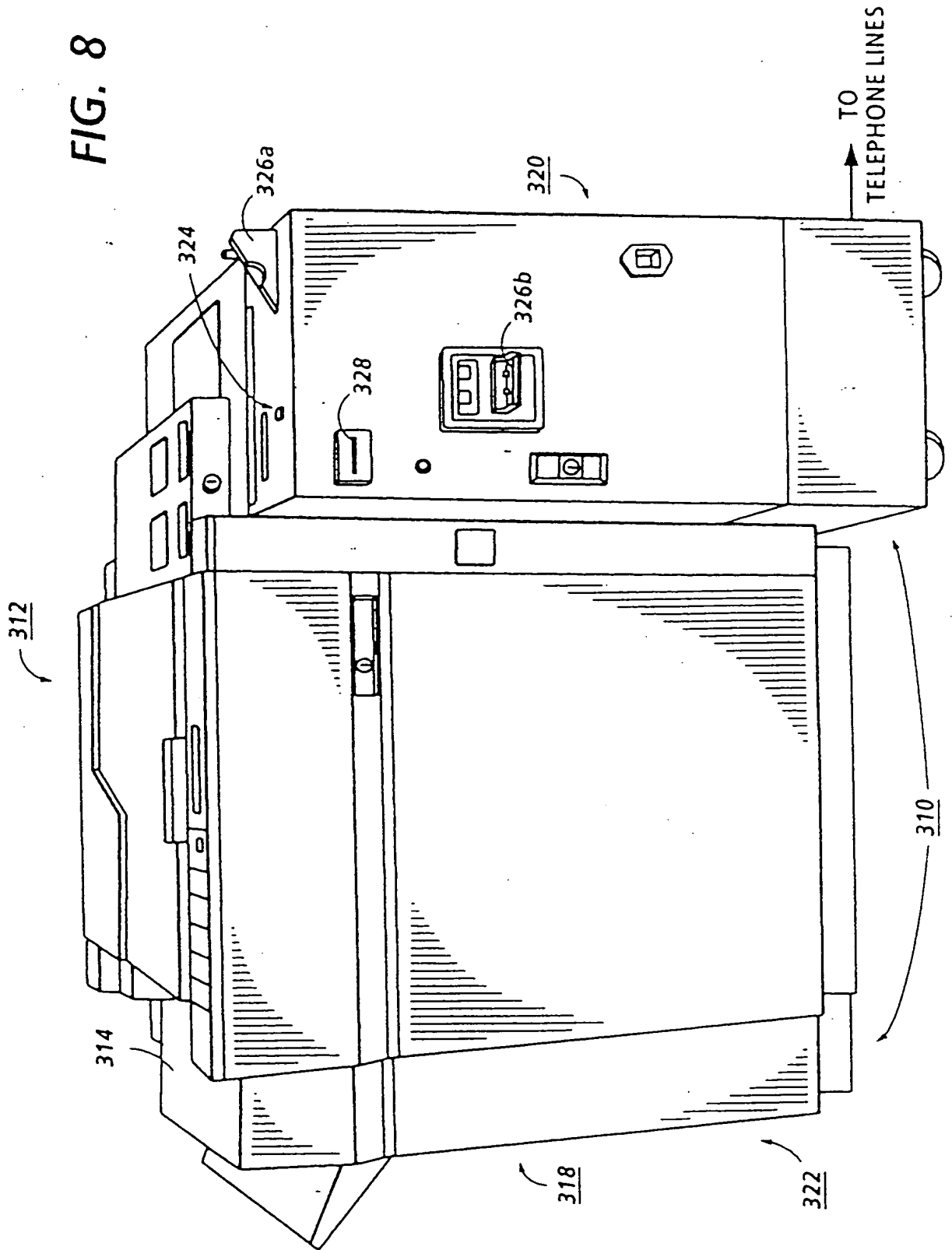


FIG. 7

FIG. 8





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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 7636

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 6)
D, X D, Y	US-A-4 908 873 (PHILIBERT ET AL.) * column 3, line 26 - column 5, line 32; figure 1 *	1, 2 8, 11	G03G21/02 G03G21/04
Y	XEROX DISCLOSURE JOURNAL., vol.4, no.2, March/April 1979, STAMFORD, CONN US pages 273 - 274 ROY J. LAHR ET AL. 'PREVENTION OF COPYING COPYRIGHTED DOCUMENTS' * the whole document *	10	
D, Y	US-A-5 245 165 (ZHANG) * column 3, line 7 - line 39; figures 1-5C *	8, 10, 11	
A	IBM TECHNICAL DISCLOSURE BULLETIN., vol.21, no.4, September 1978, NEW YORK US pages 1505 - 1507 M. KINDERMANN 'LOGGING AND MARKING COPIES LIABLE TO FEES' * the whole document *	1, 5	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 6)
D, A	EP-A-0 542 462 (XERX CORPORATION) * column 14, line 29 - line 57 * * column 19, line 6 - column 20, line 24; figures 1, 2 *	1, 3, 6, 7	G03G H04N
A	GB-A-2 139 955 (THE GENERAL ELECTRIC COMPANY P I C) * the whole document *	1, 2, 8-11	
A	IBM TECHNICAL DISCLOSURE BULLETIN., vol.18, no.6, November 1975, NEW YORK US page 2017 J. B. TAPHORN 'REPROGRAPHICS RECORD-KEEPING MACHINERY AND PROCESS' * the whole document *	1, 3, 8, 10, 11	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24 January 1995	Examiner Cigoj, P
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : oral-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : member of the same patent family, corresponding document</p>			

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European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 7636

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL. 6)
A	PATENT ABSTRACTS OF JAPAN vol. 17, no. 197 (P-1523) 16 April 1993 & JP-A-04 343 181 (CANON INC) 30 November 1992 * abstract *	1,6,10,11	
D,A	US-A-4 179 212 (LAHR) * column 5, line 45 - column 6, line 51; figures 1-7 *	1-3,6-8,10,11	
D,A	EP-A-0 549 315 (XEROX CORPORATION) * abstract *	8,10,11	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. CL. 6)
Place of search THE HAGUE		Date of completion of the search 24 January 1995	Examiner Cigoj, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : member of the same patent family, corresponding document	

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